

THE INFLUENCE OF THE REACTION PARAMETERS ON THE SYNTHESIS OF FATTY ACID HEXYL ESTERS

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INTRODUCTION

Fatty acid alkyl esters, also known as biodiesel, have different properties, depending on their structure. In addition, if obtained from waste sources of triglycerides (vegetable oils or animal fats), their overall sustainability increases. Synthesis of fatty acid hexyl esters was conducted via transesterification reaction of waste cooking oil and alcohol 1-hexanol. The catalyst used in the reactions was potassium hydroxide. Reaction parameters considered were reaction temperature, reaction time, reactant molar ratio, and catalyst mass fraction. The reactions were carried out isothermally at different temperatures of 40, 60 and 80 °C, with samples taken after 2, 5, 15, 30 and 60 minutes. The molar ratio of the reactants was either 5:1 or 12:1, with an excess of alcohol. The mass fraction of catalysts was 1% or 3%. All samples were analyzed by nuclear magnetic resonance (NMR), and the corresponding spectra were obtained to calculate the individual reaction conversions.

EXPERIMENTAL

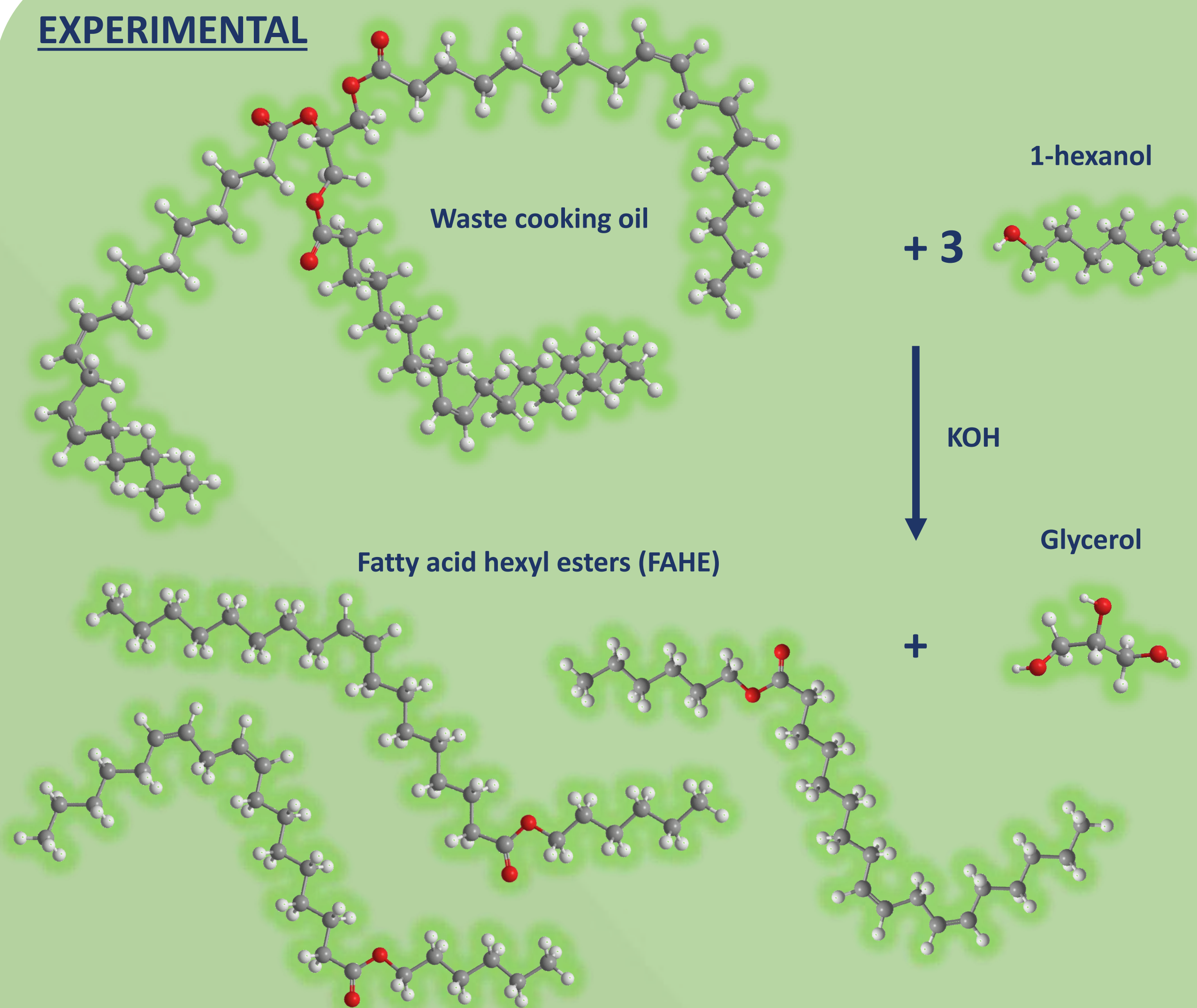
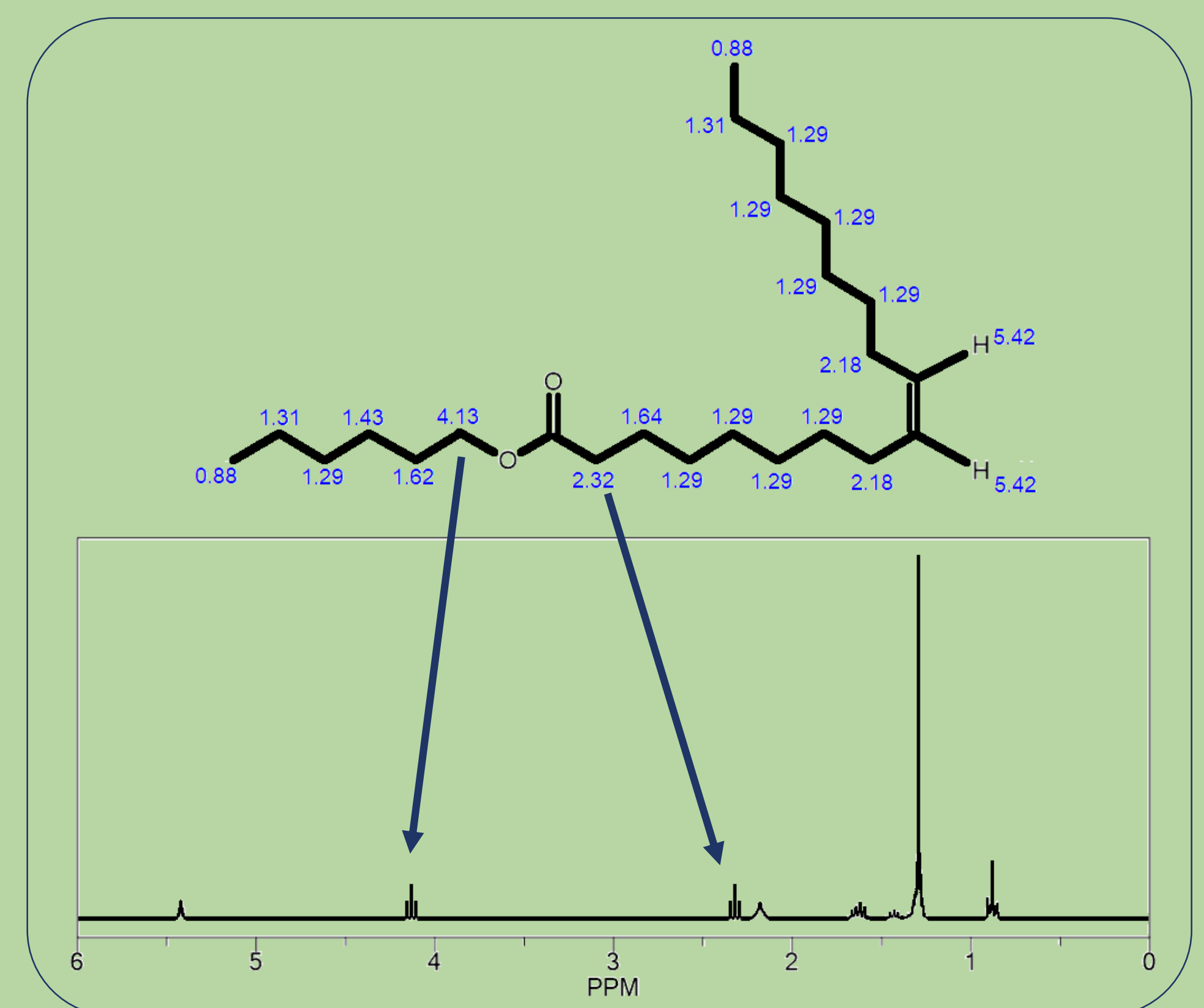


Figure 1. Transesterification reaction of FAHE



$$\text{Conversion (\%)} = \frac{\text{Surface area at 4.13 ppm}}{\text{Surface area at 2.32 ppm}} \cdot 100$$

Figure 2. An example of NMR spectrum analysis

RESULTS

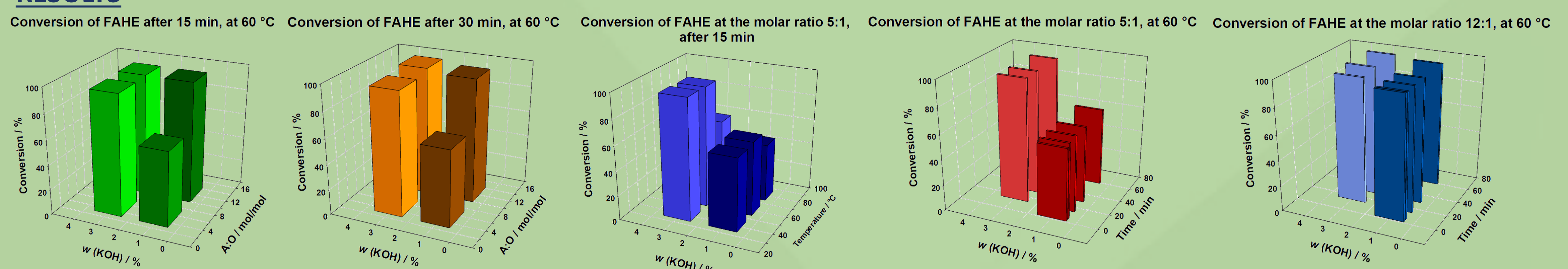


Figure 3. Conversion vs. reaction parameters

CONCLUSIONS

- ❑ The molar ratio of the reactants and the mass fraction of the catalyst are reaction parameters that significantly influence the reaction conversion of fatty acid hexyl esters (FAHE).
- ❑ The increase in the molar ratio of the reactants or the mass fraction of the catalyst results in the significant increase in the reaction conversion.
- ❑ The highest conversion value of 100 % was achieved at the temperature of 60 °C, after 30 minutes, with the molar ratio of the reactants of 12:1, and mass fraction of the catalyst of 3 %.
- ❑ The increase in the reaction temperature above 60 °C results in the decrease in the reaction conversion.
- ❑ The influence of time on the reaction conversion is minor to none due to most conversions reaching their maximum after period of only 5 minutes.

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