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# Biodiesel Preparation Using CaO as Catalyst

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***Keywords* – rapeseed oil, heterogeneous alkaline catalysts, biodiesel, CaO, transesterification, optimization.**

## I. Introduction

Studies of the transesterification reaction of vegetable oils are of key importance in the development of a country's national economy. By optimizing the conditions of the biodiesel preparation process it is possible to achieve significant savings of energy resources and raw materials, thus reducing the end product cost. The decrease in the price of biodiesel will encourage consumer interest and demand, ensuring further development of domestic resources and production to meet transportation requirements. In the biodiesel industry, homogeneous alkaline catalysts such as NaOH, KOH and $NaOCH_3$ are used most widely. These catalysts provide high transesterification reaction yield and ester content with a minimal reaction time. Usually after the biodiesel production process homogeneous alkaline catalysts that are in high concentration in the crude biodiesel and glycerol, are neutralized by using mineral acids and isolated in the form of salts. These additional operations and consumption of raw materials significantly increase the cost of biodiesel production. Use of effective heterogeneous catalysts for the transesterification reaction in biodiesel production would enable the development of a no-waste technology [1] and hence result in an economic benefit. CaO is a common local ingredient in Latvia that is derived from the limestone and can be used as heterogeneous alkaline catalyst in a transesterification reaction of vegetable oils or animal fats [1-3].

## II. Results and Discussion

CaO of purity >98% (purchased from Sigma – Aldrich Chemie Gmbh) was used in the experiment to determine the CaO influence on the process of obtaining RME (rapeseed oil fatty acid methyl esters). In this abstract the effect of CaO concentration (1-7% of rapeseed oil mass) on RME preparation process was examined while using a 6 : 1 molar ratio of methanol to rapeseed oil (see Fig. 1). The temperature for the experiment was sustained at 70 $^{o}$C and reaction time from 10 to 180 min was used. The obtained results were compared to NaOH (0.5%) catalyzed RME production process that was conducted under similar conditions.

The results show that using 1% CaO as catalyst a content of ~82% RME was attained, although the reaction equilibrium was not reached. However, using CaO of higher concentration (3 - 7%) led to reaching reaction equilibrium within approximately 180 min with a RME content of 94.2 - 95.3%. Meanwhile NaOH catalyzed transesterification reaction necessitated ~30 min long reaction time to reach the RME of similar content. Using NaOH as catalyst a maximum RME conversion (~97%) was achieved in ≥60 min that is by ~1.7% higher compared to CaO catalyzed reaction.

## III. SUMMARY

In the experiment CaO was used as a catalyst in order to determine its influence on the process of obtaining RME. Eventually CaO concentration on RME obtaining process was examined and the results were compared to NaOH catalyzed RME production process that was performed under similar conditions.

## IV. References

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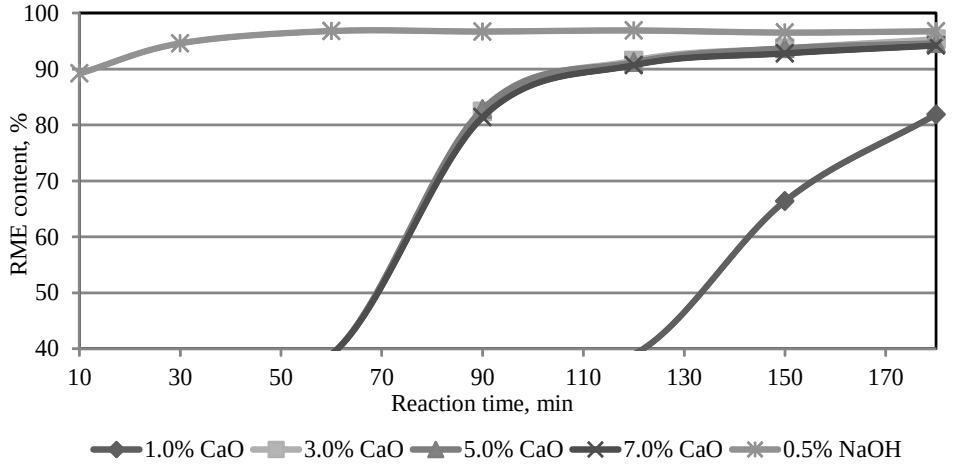


Fig. 1. Influence of catalyst concentration on RME preparation process

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