IONIC LIQUIDS AS SOLVENTS AND CATALYSTS IN THE SYNTHESIS OF LACTIC ACID ESTERS

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1

Set for the synthesis of esters in ionic liquid

2

HANNA Refractometer HI96800

3

Gas chromatograph and chromatographic vessel with stoppers

4

UV/VIS spectrophotometer

Introduction

Due to the high cost of separation and purification processes for synthetic lactic acid esters, upgrades in these technologies are being developed. One way is to conduct transesterification using a co-solvent such as ionic liquid. These can catalyse esterification and transesterification reactions.

Purpose of research

The aim of this part of the Rector's grant was to investigate ionic liquids as solvents and catalysts in the synthesis of lactic acid.

Research methodology

1 SYNTHESIS

Several types of imidazolines and amines were tested in combination with sulphuric acid (VI) and nitric acid (V). Finally, a mixture of triethylamine with sulphuric (VI) acid was selected. The miscibility of the reaction components with the ioncic liquid and the possibility of using an additional solvent to extract the ester from the ionic liquid were then checked. It was decided that toluene would be the best solvent. The reason for this was the formation of a homogeneous mixture of this solvent and lactic acid methyl esters, while at the same time a biphasic system was formed with toluene and the ionic liquid.

2 REFRACTIVE INDEX OF LIGHT

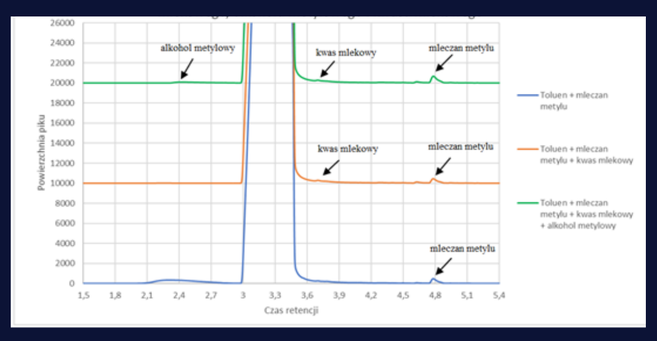
The refractive index of the samples and the solvent (toluene) as well as the standards of lactic acid methyl esters and ethyl esters were investigated. On the basis of the results, the approximate concentrations of the esters studied in the post-reaction mixtures were determined.

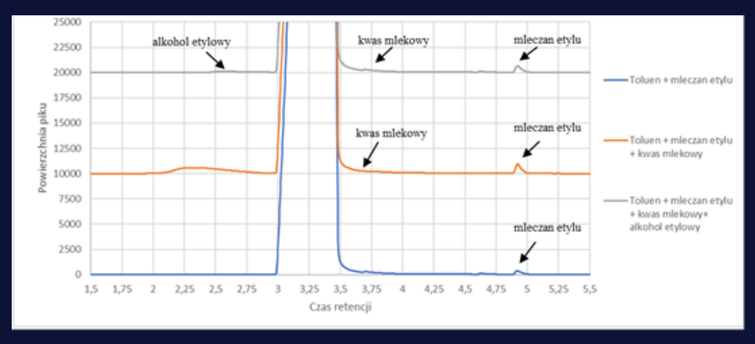
3 CHROMATOGRAPHIC METHOD

In a further part of the study, qualitative gas chromatography tests were performed on the samples. Peaks corresponding to the presence of lactic acid methyl esters were observed on the obtained chromatograms. The next part of the study was a qualitative examination with a gas chromatograph. A peak of ethyl lactate or methyl lactate was observed for each of the proposed synthesis conditions.

4 UV/VIS SPECTROSCOPY

The final element of the study was the collection of UV/VIS spectra for the mixtures obtained, separately for the lower parts (ionic liquid phase) and the upper parts (toluene phase). For most of the mixtures, spectra with peaks characteristic of the methyl and ethyl esters of lactic acid were obtained.





Retention times for individual ethyl lactate-bound components of the mixture

Conclusion

By analysing the results of the study, it is possible to determine what effect the molar ratio of amine to sulphuric acid (VI) had on the production of esters and the effect of the molar ratio of lactic acid to ethanol or methyl alcohol on the esterification process using ionic liquid. A qualitative test for the presence of esters in the sample, carried out using gas chromatography, confirmed the presence of esters in the samples.

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