

Ahmet Yavuz Oral

Zehra Banu Bahsi Oral *Editors*

# 3rd International Multidisciplinary Microscopy and Microanalysis Congress (InterM)

Proceedings, Oludeniz, Turkey, 19–23  
October 2015

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Ahmet Yavuz Oral · Zehra Banu Bahsi Oral  
Editors

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# Preface

The 3rd International Multidisciplinary Microscopy Congress (InterM2015) provided all scientists the opportunity to meet, present their work, discuss and mutually interact in order to enhance and promote their research work.

This volume, published by Springer, includes selected papers presented at this congress, held in Oludeniz, Turkey, October 19–23, 2015.

On behalf of the organizing committee we would like to thank all the participants, plenary and invited speakers for their valuable contribution.

We would also like to thank AIGTUR for their support in the organization of the congress as well as the publishers for the quality of this edition.

Gebze, Turkey

Ahmet Yavuz Oral  
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# Exploration of Carbon Based Solid Acid Catalyst Derived from Corn Starch for Conversion of Non-edible Oil into Biodiesel

Judy R.B. Witono, Ken Hashigata, Herry Santoso  
and Inge W. Noordergraaf

**Abstract** To avoid the problems caused by free fatty acids in the conversion of low cost vegetable oils to biodiesel, the use of solid acid catalyst for (trans-) esterification reaction is considered. Such a catalyst could be produced eco-friendly by using renewable raw materials such as biomass. The use of starch for this purpose is still very limited. In this paper, various methods were explored to produce a solid acid catalyst from corn starch. We investigated two different carbonization methods: complete pyrolysis in an oxygen-free environment and hydrothermal carbonization at milder conditions. Starch was used either in the native form or as pregelatinized starch. After the carbonization, acidic sites were introduced by sulfonating the materials. To characterize the catalysts, Scanning Electron Microscopy (SEM) was applied while the sulfonic content was determined by Energy Dispersive X-ray Spectroscopy (EDS). To test the performance of the catalysts, the conversion of free fatty acids was determined using oleic acid as a representative component of biodiesel feedstock. By both of the carbonization methods, a catalyst can be obtained that shows up to 84 % conversion of oleic acid. The hydrothermal treatment may then be preferred since it can be done at milder conditions. Differences between the performances of the respective catalyst samples could be well explained by structural features seen in the SEM-pictures. These also have

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