

# BOOK of ABSTRACTS

## 25<sup>th</sup> Congress of Chemists and Technologists of Macedonia



19-22 9 2018  
OHRID, R MACEDONIA





**Сојуз на хемичарите и технолозите на Македонија**

**Society of Chemists and Technologists of Macedonia**

**25<sup>th</sup> Congress of SCTM  
with international participation**

**BOOK of ABSTRACTS**

**19–22 September 2018  
Metropol Lake Resort  
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**Society of Chemists and Technologists of Macedonia**

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Ss. Cyril and Methodius University, Skopje



Goce Delčev University, Štip



The 25<sup>th</sup> Congress of SCTM is a



recognized event.

Dear Colleagues,

Welcome to the 25<sup>th</sup> Congress of the Society of Chemists and Technologists of Macedonia. Although this is our silver jubilee, our society is celebrating more than 50 years of scientific meetings. The first conference, one of the first activities of our society, was organized in the 1960-ties and was a meeting between the faculties of the Institute of Chemistry at Faculty of Sciences and Mathematics and the Faculty of Technologists, both at the Ss. Cyril and Methodius University in Skopje. They gradually grew into biennial meetings and attracted participants outside of Macedonia. Beginning from the 18<sup>th</sup> Congress in 2004 all our meetings are held in the exceptional setting of Lake Ohrid. In 1994 our society started to organize students' scientific meetings and now the two alternate, so there is a congress organized by our society every year.

Since 2012 we have been using the Open Journal System to manage the editorial process of the [\*Macedonian Journal of Chemistry and Chemical Engineering\*](#) published by our society. In order to streamline the technical management of this congress and future such meetings, we have undertaken for the first time to implement the Open Conference System. You are all now familiar with the whole process of registering, submitting the abstracts etc. – at times you/we did encounter problems but overall we are satisfied with this platform and plan to use it in the future. For all of you who have smart phones, you will find the abstracts and schedule online which can be searched by various criteria. Furthermore, in line with the digital age we live in, for the first time we will not have a printed Book of Abstracts but only an electronic one. A draft version with all submitted abstracts along with the conference program was uploaded to the platform three weeks ago. The final version will be available after the conference and only the presented contributions will be included. Another first at this conference will be a Skype presentation on Saturday. We hope in the future to further improve the technical capabilities by streaming at least some of the lectures online.

Next year the world will be celebrating 150 years of Mendeleev's Periodic table of the chemical elements. Our society was involved from the very beginning two years ago – we immediately contacted our representative to UNESCO to give our full support for this important event marking one of the few discoveries in science that has withstood such a long test of time. It is nice to see the world united in a scientific achievement despite the extreme polarization in other areas. I believe you share my opinion that we are so fortunate to have chosen to pursue chemistry, the ever evolving science. Whenever I hear divisive undignified debates that take place so often now, the words of Sir Humphrey Davy in his discourse delivered at the Royal Society, in November 1825 echo in my ears: *Fortunately science, like that nature to which it belongs, is neither limited by time nor by space. It belongs to the world, and is of no country and of no age. The more we know, the more we feel our ignorance; the more we feel how much remains unknown; and in philosophy, the sentiment of the Macedonian hero can never apply, – there are always new worlds to conquer.*

From the more than 250 contributions given in this book we have a truly diverse body of researchers in many fields of chemistry. But more important than the number is the quality of the scientists presenting their new results: we have two exceptional keynote speakers, 10 invited speakers, 49 oral presentations and 195 poster presentations. Due to the traditional environment of tolerance in Macedonia, it is a truly unique regional conference bringing together the scientists from a very wide area.

I would like to thank sincerely the presidents of the Organizing and Scientific Committees, Prof. Viktor Stefov and Prof. Trajče Stafilov. Also, I must mention Assistant Prof. Jasmina Petreska-Stanoeva and Prof. Marina Stefova. I think this is the best team we could put together to make a really flawless organization. Furthermore, I would like to thank the Ministry of Education and Science of Macedonia, the Ss. Cyril and Methodius University in Skopje and the Goce Delčev University in Štip for their financial support, as well as the commercial sponsors that are given at the end of this book for their financial support and/or support in their products.

I do hope you will enjoy the scientific program of this congress, the interactions with colleagues from other institutions and countries and will build new relationships and collaborations. Most of all I would like to ask you to spend some time with the young researchers and students present here – for one of our main goals is also to build on the nexus between education and research and inspire and energize the young in the intricacies of the science of chemistry. I know I do not need to tell you to enjoy this magnificent lake, for us the most beautiful lake in the world, the inspirational crammed with extraordinary churches city of Ohrid and its unique heritage to world civilization.

Prof. Zoran Zdravkovski, president  
Society of Chemists and Technologists of Macedonia

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## ICTM P-18

### SEVERAL ASH FEATURES OBTAINED FROM RICE HUSK

Aco Janevski<sup>1</sup>, Krsto Blazev<sup>1</sup>, Darko Andronikov<sup>1</sup>, Kiro Mojsov<sup>1</sup>, Sonja Jordeva<sup>1</sup>, Marija Kertakova<sup>1</sup>, Afrodita Zendelska<sup>2</sup>

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Annual production of rice in the Republic of Macedonia is 19 000 - 35 000 t, bearing in mind that about 22% of the mass belongs to rice husk. Even though rice husk is rich with silica and has high caloric value, in our country is treated as a waste, its disposal is serious problem for processors. Rice husk ash (RHA) is one of the most silica, rich raw material containing about 85-95% silica after a complete combustion. In the past, combustion was the only way rice processors handled it, without taking into account the consequences for the environment. Certain quantities of ash obtained by uncontrolled combustion exist at the landfills. In this work characteristics at RHA, obtained by uncontrolled combustion are examined. It is a snow-white powder with a low density (about 130 kg / m<sup>3</sup>), and the dimensions of the particles are between 10 and 200 microns (measured by laser granulometry). Compared with the density of a sand, silica particles with similar dimensions is 1460 kg/m<sup>3</sup> which indicates a highly porous structure of RHA. X-ray diffractograms and FTIR spectra indicate an crystal silica structure. X-ray fluorescence spectra, show the large presence of Silicon, and small quantities of Aluminum and Iron in RHA. These characteristics of RHA gives opportunity for its use as filler absorbents and further processing in more sophisticated and high cost silica materials.

**Keywords:** rice husk, combustion, ash.

# SEVERAL ASH FEATURES OBTAINED FROM RICE HUSK

Aco Janevski<sup>1,2</sup>, Krsto Blazev<sup>1</sup>, Darko Andronikov<sup>1</sup>, Kiro Mojsov<sup>1</sup>, Sonja Jordeva<sup>1</sup>,  
Marija Kertakova<sup>1</sup> and Afrodita Zendelska<sup>1</sup>

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## Introduction

Annual production of rice in the Republic of Macedonia is 19 000 - 35 000 t, bearing in mind that about 22% of the mass belongs to rice husk. Even though rice husk is rich with silica and has high calorific value, in our country is treated as a waste, its disposal is serious problem for processors[1]. Rice husk ash (RHA) is one of the most silica, rich raw material containing about 85-95% silica after a complete combustion. In the past, combustion was the only way rice processors handled it, without taking into account the consequences for the environment. Certain quantities of ash obtained by uncontrolled combustion exist at the landfills. In this work characteristics at RHA, obtained by uncontrolled combustion are examined.



Figure 1: Picture at landfill of rice husk on company Mak Mlin Cesinovo.

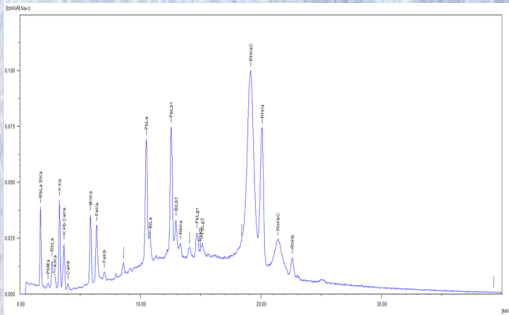


Figure 2: X-ray fluorescence spectra of RHA.

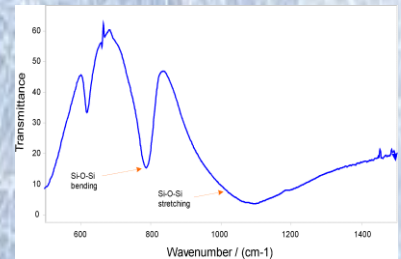


Figure 3: FTIR spectra of RHA.



Figure 5: Picture of RHA.

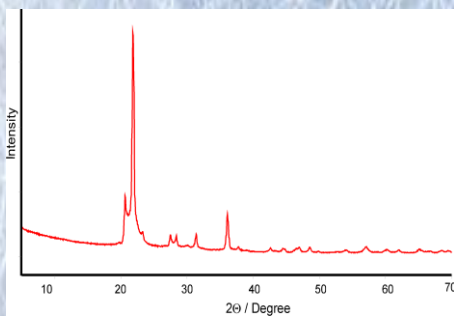


Figure 4: X-ray diffractogram of RHA.

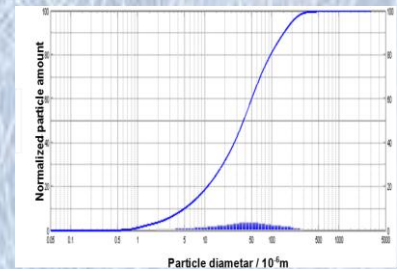


Figure 6: Particle distribution of RHA.

## References

- [1] Janevski, A.; Blazev, K.; Mojsov, K.; Andronikov, D. Production of silica from rice husk. *Natural resources and technology* **2017**, *11*, 121-125
- [2] Rozainee, M.; Ngo, S.P.; Salema, A.A.; Tan, K.G.; Ariffin, M.; Zainura, Z.N. Effect of fluidising velocity on the combustion of rice husk in a bench-scale fluidised bed combustor for the production of amorphous rice husk ash. *Bioresour. Technol.* **2008**, *99*, 703-713. DOI.org/10.1016.biortech.2007.01.049

## Conclusions

It is a snow-white powder with a low density (about  $130 \text{ kg m}^{-3}$ ), and the dimensions of the particles are between 100 and 200 microns (measured by laser granulometry). Compared with the density of a sand, silica particles with similar dimensions is  $1460 \text{ kg m}^{-3}$  [2] which indicates a highly porous structure of RHA. X-ray diffractograms and FTIR spectra indicate a crystal silica structure. X-ray fluorescence spectra, show the large presence of Silicon, and small quantities of Aluminum and Iron in RHA. These characteristics of RHA gives opportunity for its use as filler absorbents and further processing in more sophisticated and high cost silica materials.



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issues this

# CERTIFICATE

to the authors:

Aco Janevski, Krsto Blazeв, Darko Andronikov, Kiro Mojsov, Sonja Jordeva,  
Marija Kertakova, Afrodita Zendelska

for the poster presentation titled:

**SEVERAL ASH FEATURES OBTAINED FROM RICE HUSK (ICTM, P-18)**

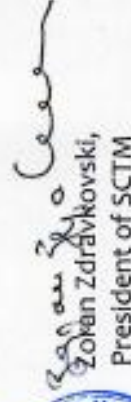
  
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Viktor Stefov,

President of the Organizing committee



  
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