

ATTITUDE

by Assoc. Prof. DSc Stefan Penchev Marinov

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Subject: Dissertation on "Development of environmental catalysts for the production of valuable chemicals and fuels through the utilization of biomass", presented by PhD student chemist Hristina Lazarova for the award of educational and scientific degree "PhD" in professional field 4.2. " Chemical Sciences ", scientific specialty " Organic Chemistry " with scientific supervisor Prof. PhD Margarita Popova.

I. General presentation of the procedure and the doctoral student

By order (№RD-09-167 / 30.07.2021) of the Director of IOCCP-BAS Prof. Dr. Vanya Kurteva, after a decision of the Scientific Consult (protocol №22 / 29.07.2021), I was confirmed as a member of the Scientific Jury (SJ) in connection with the opening of a procedure for the defense of a doctoral dissertation for the acquisition of the educational and scientific degree "PhD" by chemist Christina Lazarova. The first meeting for structuring SJ was held on 02.08.2021, at which I was appointed to prepare an attitude.

Christina Lazarova is a graduate of Sofia University "St. Kl. Ohridski" and obtained a master's degree in 2010 with a specialty "Medical Chemistry". The doctoral student was enrolled for a doctoral program in independent preparation from 17.01.2020 (order №ПД-09-9 / 17.01.2020) and protocol of the Scientific Consult (№1 from 16.01.2020) with scientific supervisor Prof. PhD Margarita Popova and deducted with the right to defense, as of 01.08.2021. (order № RD-09-170 / 30.07.2021) and decision of the Scientific Consult (protocol №22 of 29.07.2021). The dissertation was discussed and directed for defense by the extended staff of the Colloquium on "Functional Materials, Computer Modeling and Technology" on 28.07.2021.

The presented dissertation is written on 135 pages, contains 54 figures and 22 tables and includes 241 literature sources.

II. Basic problems

1. Actuality of theme

The global depletion of fossil fuel, liquid and gaseous fuels, as well as the accompanying environmental problems, are forcing researchers to look for alternatives and develop new clean technologies for their use. The conversion of

lignocellulosic biomass into valuable chemicals, materials and fuels is a promising alternative to reduce dependence on fossil fuels. By pre-chemical treatments of lignocellulosic biomass using non-food raw materials and highly efficient catalysts, valuable organic compounds with starting C₅ and C₆ basic molecules can be obtained, among which levulinic acid after suitable processes and catalysts can be obtained, receiving cost-effective biofuels and valuable chemicals. This determines the relevance of the topic and its economic importance.

2. Knowledge of the problem

Proof of good knowledge of the problem are the 241 literary sources cited in the dissertation, which are commented in the literature review competently in connection with the goals and objectives set in the dissertation. The author's abstract contains 6 publications in which the PhD student is a co-author and this reflects an impressive amount of experimental research work, in which she undoubtedly gained practical skills and significantly deepened her knowledge of the problem. Based on an in-depth review of the literature related to biomass utilization, zeolite catalysis and post-synthetic techniques for obtaining new structures of micro- and mesoporous silicates and nanosized metal oxides for use in esterification processes in biomass utilization, the PhD student clearly formulates the goal of its research and the specific tasks arising from it.

III. Research methodology

The research methodology is the development and application of various post-synthetic procedures for the preparation of new silicate catalysts with high catalytic activity in the esterification of glycerol and levulinic acid. A number of classical and modern physicochemical techniques have been used to characterize the obtained micro- and mesoporous materials, such as: nitrogen physisorption, X-ray diffraction, full-spectrum IR spectroscopy, scanning and transmission electron microscopy, solid-phase NMR spectroscopy, thermo programming of ammonia. The PhD student was well and sufficiently trained for the use and application of all these techniques.

IV. Characteristics and evaluation of the dissertation and contributions

As an overall feature of the dissertation can be highlighted the impressive volume of research work with the involvement of a large number of experimental methods, which have undoubtedly contributed to the scientific growth of Christina Lazarova. The PhD student's contributions to the development of various post-synthetic procedures for obtaining new highly efficient micro- and mesoporous silicate materials with controllable catalytic properties are an important scientific-applied contribution. Specifically, the obtained new, highly efficient and cheap silicate

catalysts for esterification of glycerol and levulinic acid are important applied contributions.

V. Publication activity, participation in scientific events and personal contribution of the PhD student

The PhD student is a co-author of six scientific publications published in journals with high IF from 3.6 to 5.7, such as Catalysis Communications, Microporous and Mesoporous Materials and Applied Catalysis. In one of the publications the PhD student is the first author. The scientific community is acquainted with a large part of the results obtained through the reports presented by the PhD student at 9 scientific events. The high scientific qualities of the published publications are confirmed by the noticed 57 citations, despite the short time from publishing.

I believe that the personal contribution of the PhD student is in the practical experimental activity, as well as in the extraction of the huge number of literary sources and assimilation of their content, necessary for the interpretation of the obtained results. In explaining the experimental results, of course, she received strong support from her supervisor Prof. Margarita Popova. As for the foreign co-authors, it is difficult for me to assess and separate their contribution from the PhD student's contributions, but in this case the important thing is the access to equipment that is missing in our country.

VI. Abstract

The presented abstract in Bulgarian and English clearly and precisely in a concise form reflects the essence of the dissertation. The 25 figures and 1 table included in the abstract are completely sufficient from the point of view of expressing an opinion on the dissertation.

CONCLUSION

The dissertation of PhD student Christina Lazarova contains new data about the studied objects. The analysis of the results of the PhD program shows that the PhD student was well trained. She has mastered and applied a number of modern analytical methods and techniques. Her publishing activity, her participation in scientific forums, as well as her successfully passed exams, have contributed to her scientific growth. At all points of the credit system of BAS for assessment of the preparation of PhD students, Christina Lazarova many times exceeds the requirements with a total number of credits of 726 points with a minimum number of required 250 points.

The PhD student with the presented materials meets the requirements of ZRASRB and the Regulations for its application, made in IOCCP-BAS. In conclusion, I strongly recommend to the members of the esteemed Scientific Jury to award the PhD student Christina Lazarova the educational and scientific degree "PhD" in the professional field 4.2. "Chemical Sciences", scientific specialty "Organic Chemistry".

Date 17.09.2021

Prepared by:

/Assoc. Prof. DSc Stefan Marinov/