

OPINION

by **Dr. Stanimir Petrov Manolov** – Associate professor
Faculty of Chemistry, “Paisii Hilendarski” University of Plovdiv

of a dissertation thesis submitted for the award of the educational and scientific degree Doctor in:

Field of Higher Education: 4. Natural Sciences, Mathematics and Informatics,

Professional Field: 4.2. Chemical Sciences,

Doctoral Programme: Organic chemistry

Author: Maria Valentinova Bachvarova

Title: „Synthetic Transformations of 2-Arylthiazole and Benzothiazole Compounds“

Scientific Supervisor: Assoc. Prof. Stela Statkova-Abeghe, PhD – University of Plovdiv
“Paisii Hilendarski”

1. General Overview of the Procedure and the PhD Candidate

By Order No. RD-22-1002/15.05.2026 of the Rector of „Paisii Hilendarski“ University of Plovdiv, I was appointed as a member of the Scientific Jury for the procedure concerning the public defense of the dissertation thesis entitled “*Synthetic Transformations of 2-Arylthiazole and Benzothiazole Compounds*”, submitted for the award of the educational and scientific degree Doctor in the Field of Higher Education 4. Natural Sciences, Mathematics and Informatics, Professional Field 4.2 Chemical Sciences, Doctoral Programme Organic Chemistry.

The dissertation was prepared by Maria Valentinova Bachvarova, a PhD candidate at the Department of Organic Chemistry, Faculty of Chemistry, „Paisii Hilendarski“ University of Plovdiv, under the supervision of Assoc. Prof. Stela Statkova-Abeghe, PhD.

The submitted set of materials complies with the requirements of the Regulations for the Development of the Academic Staff of Paisii Hilendarski University of Plovdiv and includes all documents necessary for conducting the procedure. The submitted documentation comprises the dissertation thesis, an abstract of the dissertation, and scientific publications related to the dissertation topic.

2. Relevance of the Research Topic

Research related to the synthesis and chemical transformations of heterocyclic compounds represents one of the most dynamically developing areas in contemporary organic and medicinal chemistry. Thiazole and benzothiazole derivatives are among the most important heterocyclic systems due to their broad spectrum of biological activities, including anticancer, antifungal, antiviral, anti-inflammatory, and other pharmacologically relevant properties.

Particular interest is focused on structural analogues of naturally occurring phytoalexins such as camalexin, as well as on the possibilities for their targeted structural modification aimed at obtaining novel compounds with improved biological and physicochemical properties. In this context, the development of new synthetic approaches for the functionalization of 2-aryl and 2-heteroaryl thiazole and benzothiazole derivatives constitutes a highly relevant scientific task with potential applications in both medicinal chemistry and plant protection.

The topic of the dissertation is modern, promising, and characterized by clear scientific significance and practical applicability.

3. Knowledge of the Research Problem

The PhD candidate demonstrates an excellent understanding of the scientific problem addressed in the dissertation, as well as of the current state of research in the field. The literature review is comprehensive and well-structured, covering a substantial number of publications related to the biological activity of thiazole and benzothiazole derivatives, natural phytoalexins, synthetic approaches to camalexin analogues, α -amidoalkylation reactions, and various oxidative transformations.

Particularly noteworthy is the critical analysis of the existing synthetic methodologies and the clear identification of unresolved scientific issues, which provide a sound justification for the objectives and research tasks defined in the dissertation.

The cited literature is current, relevant, and demonstrates the candidate's excellent awareness of the contemporary scientific achievements and trends in this research area.

4. Research Methodology

To achieve the stated objectives, the PhD candidate employed contemporary methods of organic synthesis, including α -amidoalkylation reactions, oxidative transformations, and reductive processes for the functionalization of thiazole and benzothiazole derivatives.

The synthesized compounds were characterized using a comprehensive set of modern physicochemical techniques, including NMR spectroscopy, infrared spectroscopy, and high-resolution mass spectrometry (HRMS).

The applied methodology is well selected and fully appropriate for accomplishing the research objectives. The experimental procedures are described in sufficient detail, ensuring the reproducibility and reliability of the reported results.

5. Evaluation of the Dissertation Thesis and Scientific Contributions

The dissertation thesis comprises 146 pages and is structured into an introduction, literature review, results and discussion, experimental section, summary of results and conclusions, publications, and references.

The main scientific contributions of the dissertation can be summarized as follows:

1. The scope of the α -amidoalkylation reaction has been expanded through the development of novel synthetic approaches for the functionalization of 2-aryl and 2-heteroaryl thiazole and benzothiazole systems.
2. New precursors for the synthesis of the natural phytoalexin N-methylcamalexin and various oxy-camalexin derivatives have been obtained.
3. Oxidative transformations of 2-indolyl-thiazolines and N-acyl-2-(1-ferrocenyl)-benzothiazolines have been investigated, and efficient conditions for their aromatization have been established.
4. New approaches have been developed for the unmasking of a “hidden” aldehyde functional group through reductive transformations of Troc-protected heterocyclic derivatives.
5. Novel heterocyclic structures of interest as potential biologically active compounds and promising precursors for future studies have been synthesized and characterized.

The results obtained are original in nature and constitute a substantial contribution to the advancement of synthetic organic chemistry. The scientific contributions presented in the dissertation are clearly formulated and are fully consistent with the objectives and tasks set forth in the research work.

6. Evaluation of the Publications and the Personal Contribution of the PhD Candidate

The results of the dissertation research have been disseminated through two scientific publications and fifteen presentations at scientific conferences and forums. The publication activity adequately reflects the main findings of the dissertation and demonstrates their scientific significance. The published work has already received one citation.

The submitted materials clearly show that Maria Bachvarova actively participated in all stages of the research process, including the planning and execution of the synthetic experiments, the analysis and interpretation of the results, the structural characterization of the synthesized compounds, and the preparation of the scientific publications.

In my opinion, the personal contribution of the PhD candidate is substantial and convincingly demonstrated.

7. Abstract

The submitted dissertation abstract has been prepared in accordance with the requirements for the award of the educational and scientific degree Doctor (PhD) and fully reflects the content of the dissertation thesis. Within its 32 pages, the relevance of the research topic, the aims and objectives of the dissertation, the experimental approaches employed, the results obtained, and the conclusions drawn are presented clearly and systematically.

The abstract accurately reflects the scientific contributions of the dissertation, including the development of novel synthetic approaches for the functionalization of 2-aryl and 2-heteroaryl

thiazole and benzothiazole compounds, the synthesis of the natural phytoalexin N-methylcamalexin and a series of novel oxy-camalexin analogues, as well as the investigation of oxidative and reductive transformations of the corresponding precursors.

In my opinion, the dissertation abstract provides a reliable and objective presentation of the most significant results of the dissertation research and offers a clear understanding of its scientific value and the contributions of the PhD candidate.

8. Recommendations for Future Research and Application of the Results

The results obtained provide a solid foundation for future investigations into the biological activity of the synthesized compounds and for the development of novel analogues of natural phytoalexins with potential applications in medicinal chemistry and plant protection.

I would recommend that selected synthesized structures be subjected to more extensive biological evaluation, which would allow a more comprehensive assessment of their practical potential and possible applications.

CONCLUSION

The submitted dissertation thesis contains original scientific results and scientifically applied contributions in the field of organic synthesis and the chemistry of heterocyclic compounds. The work has been carried out at a high scientific level and fully complies with the requirements of the Academic Staff Development Act of the Republic of Bulgaria, the Regulations for its implementation, and the Regulations of “Paisii Hilendarski” University of Plovdiv.

The dissertation convincingly demonstrates that Maria Valentinova Bachvarova possesses profound theoretical knowledge and the necessary skills for conducting independent scientific research in the field of Organic Chemistry.

In view of the above, I give my **positive** assessment of the dissertation thesis and confidently recommend that the esteemed Scientific Jury award Maria Valentinova Bachvarova the educational and scientific degree **Doctor (PhD)** in the Field of Higher Education **4. Natural Sciences, Mathematics and Informatics**, Professional Field **4.2 Chemical Sciences**, Doctoral Programme **Organic Chemistry**.

08.06.2026 г.

Assessment prepared by:

(signature)

Assoc. Prof. Dr. Stanimir Manolov