



REVIEW

by Professor Mariyana Vladimirova Filipova-Marinova,

Doctor of Biological Sciences

<https://ras.nacid.bg/dissertation-preview/3839>

Member of the Scientific Jury by Order No. RD-16-1089 from 26th of November 2020 of the Rector of the Agricultural University – Plovdiv (Bulgaria) regarding a Procedure for awarding the educational and scientific degree “Doctor of Philosophy, **PhD**” to **Nguyen Cao Nguyen**, Part-time PhD student at the Department of Chemistry and Phytopharmacy for Dissertation Work entitled „*Study of the technological processes of zinc hydroxide nitrate nanocrystals production applying for foliar fertilizer for important agricultural plants*“ in the Higher educational area cipher 4.: Natural Sciences, Mathematics and Informatics; Professional area cipher 4.4.: Earth Sciences; research specialty “Ecology and Environmental Protection”

1. General characteristics of the dissertation – contents and structure

Nguyen Cao Nguyen's dissertation is presented in English with a summary in Bulgarian with a total content of 172 pages. It is structured in 5 chapters main text of 160 pages, as follows: Introduction (14 pages), Material and methods (4 pages), Experimental results and discussion (119 pages), Contributions and conclusions (4 pages), Bibliography (19 pages). The required ratio between the size of the main sections is observed, with an emphasis on the results in two main directions and their discussion. It should be noted that the results are presented on the model of Western European dissertations. The figures (63 pcs.) and tables (53 pcs.) facilitate the presentation and interpretation of the results. For greater clarity, a list of abbreviations used is presented. **The purpose of the dissertation is clearly stated, the tasks are specific.**

2. Literary awareness and theoretical preparation of the candidate

The State-of-Arts chapter is **well structured and linked to the subject** of the dissertation. It is divided into five sections related to the components of the dissertation. A sufficient number of references are cited - 163 from 1952 to 2020. The above testifies to a **good theoretical preparation** of the PhD student.

3. Methodical approach

The research approach of the dissertation is **modern** and meets the standards for conducting research and ensuring reliable results. A working hypothesis has been formulated, adequate methods and modern approaches for solving the set tasks have been selected. Modern instrumental methods have been used: X-Ray Diffraction analysis (XRD), Scanning Electron Microscopy (SEM), High-Resolution Transmission Electron Microscopy (HRTEM), thermal analysis (TG, DTG, DTA) and Chemical analysis (ICP-AES).

4. Significance and persuasiveness of the obtained results and conclusions

The obtained results are **presented correctly** and are **discussed in depth**. They are organized in eight sections, fully meeting the objectives and tasks. The data are presented with arguments and are successfully interpreted. It is reasonable concluded that suspensions of zinc containing hydroxy nitrates can be successfully applied as long-acting foliar fertilizers. I believe that **Nguyen Cao Nguyen's** dissertation is a **model** for assessing the potential of synthesized nanosize materials as foliar fertilizers. The agri-environmental problem of the content of zinc in food products is **relevant and significant**, given the importance of this trace element for human health. In order to assess the real effect of zinc nanofertilizer nutrition on the physiological and mineral status of plants as an indicator of their productivity, as well as to obtain **accurate information** on maintaining the optimal amount of zinc, which leads to a significant increase in yields and quality of agricultural production, a sensitive and reliable agri-environmental assessment method is needed. Physicochemical approaches are a powerful modern tool for solving various problems of the agricultural science, such as the stability of controlled synthesized hydroxy nitrates and the conditions for the formation of solid solutions of mixed hydroxy nitrates. **The significance of the dissertation** is determined on the one hand by the purely fundamental issue of controlled synthesis of zinc containing hydroxy nitrates and their physicochemical characterization, and on the other hand is related to the **practical orientation** in assessing the potential of synthesized nanoscale materials as foliar fertilizers for major crops in Bulgaria. and Vietnam. The lack of such research in Bulgarian and Vietnamese agroecological science determines the **originality of the research**.

5. *Critical notes to the dissertation*

In essence, I have **no critical remarks** on the dissertation. I find it appropriate to recommend the following:

- Future publications should take into account the current taxonomic status of both species: *Phyllanthus amarus* Schumach. & Thonn. that belongs to Phyllanthaceae and turmeric (*Curcuma longa* L.) that belongs to Zingiberaceae.
- In future publications, it should be taken in consideration that the species and genus name of the plants is always written in *italics*, and the author's names and family names are written in normal style.

6. *Character of scientific contributions*

I fully accept the reference for the scientific contributions of the dissertation and define them as basic research and applied research with original and confirmatory character. The fact that so far there is no research on nanofertilizers in Bulgaria emphasizes the **original character of the dissertation.**

In general, the research contributions of **Nguyen Cao Nguyen's** dissertation can be summarized as follows:

Original research contributions:

- ✓ For the first time, the conditions of controlled synthesis of zinc hydroxy nitrate and mixed zinc - copper hydroxy nitrate over the entire concentration range were studied in detail. Original results were obtained for the stability of the synthesized hydroxy nitrates and for the conditions for the formation of solid solutions in the mixed zinc-copper hydroxy nitrates.

Original research contributions with applied character:

- ✓ For the first time, the effect of the synthesized zinc containing leaf nanofertilizer on the physiological status of zinc-deficient maize plants grown under controlled conditions and in field conditions was studied with respect to: the influence of zinc nanofertilizer nutrition on the physiological and mineral status of plants; the influence of the composition of the suspension on the productivity and quality of corn grains (moisture content, proteins, fats and proteins; influence of the genotype on the efficiency of foliar fertilization with zinc containing nanofertilizers;

✓ For the first time, treatment with zinc-containing foliar fertilizer has been found to increase the curcumin content in the productive parts of turmeric grown in Vietnam.

Confirmatory research contributions with applied character:

✓ It has been confirmed that suspensions of zinc containing hydroxy nitrates can be successfully applied as long-acting foliar fertilizers.

7. Evaluation of the quality of the publications, reflecting the research on the dissertation

The PhD student has presented 5 full text publications on the topic of the dissertation, which **fully covers the scientific and metric criteria** for awarding the educational and scientific degree "PhD". **Three of the papers are published in journals with an impact factor.**

8. Personal contribution of the PhD student

The participation of the PhD student in all publications testify to his **undoubted personal contribution to the development of the dissertation** under the expert guidance of his supervisor Prof. Krassimir Ivanov, Dr. Sci. Tech. I believe that **Nguyen Cao Nguyen** has acquired the key skills of a modern researcher: consistency in mastering innovative methods, excellent theoretical training and literary awareness, and skills to work in collaboration with foreign scientists.

9. Conclusion

The presented dissertation and the accompanying materials **FULLY MEET THE REQUIREMENTS** of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Ordinance for the implementation of the Law, and the specific criteria for awarding the educational and scientific degree "PhD" at the Agricultural University Plovdiv. Given the above and my general impression that the achieved scientific contributions are real and represent a reliable basis for future research with a practical focus, **I express my POSITIVE assessment of the dissertation and I PROPOSE to the members of the scientific jury to VOTE FOR THE AWARD to Nguyen Cao Nguyen with the educational and scientific degree "PhD" in Ecology and Environmental Protection.**

01.02.2021

Varna

Reviewer: 

(Prof. Mariyana Filipova-Marinova, Dr. Sci. Biol.)