

OPINION

by Prof. Ph.D. Eng. Nina Yankova Penkova

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about a dissertation for the acquisition of an educational and scientific degree

"Doctor"

Topic: „Efficiency of the combustion process when burning pellets and waste raw materials in boilers“

Author: Eng. Nevena Milcheva Mileva

Scientific field: 5. Technical sciences

Professional field: 5.4. Energetics

Doctoral program: Thermal engineering

1. Relevance of the problem developed in the dissertation

The dissertation consists of 178 pages, including 84 figures, 36 tables, and 2 appendices, organized into 6 chapters, general conclusions, and a list of references comprising 141 titles, of which 36 are in Cyrillic, 97 in Latin, and 8 are online sources.

Environmental pollution and the extraction of natural resources pose serious challenges to the development of modern society, especially in the context of the accelerated growth of the global population. One of the key approaches to addressing these issues is the advancement and implementation of innovative technologies for the use of renewable energy sources. Biomass, as a resource with growing popularity, plays a significant role in this process. The combustion of biomass in various forms is a complex process influenced by numerous factors, whose in-depth study and optimization are of critical importance. This is precisely why I consider the topic of the dissertation to be highly relevant. The main goal is to improve the efficiency of the combustion process when burning pellets and waste materials in heating boilers. This goal is achieved through the analysis of the combustion characteristics of the materials used, optimization of the combustion process parameters, development of technologies to enhance the energy efficiency of installations, and reduction of the negative impact on the environment.

2. Main contributions

The contributions are categorized into three main groups: scientific-applied, applied, and methodological.

The scientific-applied contributions include the study of the properties of pellets of various origins through different thermal methods, as well as their classification into groups based on their intended use. Simulation models have been developed for optimizing combustion processes, and optimal operating modes have been determined. Furthermore, a cogeneration system has been created for the efficient use of waste heat to produce electricity.

The applied contributions cover the identification of the need for pre-treatment of wooden pellets to improve their characteristics for domestic use. A model has been developed for automating the fuel and air supply in the combustion process, leading to increased efficiency and reduced operational costs. The implementation of the developed cogeneration technology ensures reduced energy costs, the potential for selling green certificates, and effective management of waste materials.

The methodological contributions include the development of a universal methodology that integrates experimental research, thermal analyses, and numerical simulations, allowing adaptation to various types of fuels and combustion systems. Simulation models have been created for monitoring and predicting the efficiency and emissions of combustion processes, which comply with environmental standards and are equipped with technological parameters.

3. Critical remarks on the work presented

During the review of the dissertation, some technical errors were found in the descriptions of variables and units of measurement in the description on page 5, editorial errors, repetitions and inaccuracies.

In Section 6 of Chapter 4, the accuracy of the numerical solutions of the mathematical models is analyzed, and not the efficiency of the combustion process under different combustion conditions, as stated in the title.

It would be useful to foresee possibilities for utilizing the generated thermal energy of the cogeneration system, developed in Chapter 5.

The mentioned omissions and inaccuracies do not diminish the value of the research in the dissertation. From the research results and the overall layout of the work, it is evident that its author is a well-prepared specialist and researcher, and can independently deal with complex scientific problems. My recommendation is that Nevena Mileva continue her research in her chosen field and that the results be further developed and applied in scientific projects.

4. Conclusion

The presented dissertation fully meets the requirements for obtaining the educational and scientific degree „Doctor“. I give a positive evaluation of the achieved results and contributions in the dissertation, considering that the developed dissertation fully complies with the requirements set by the Law on the Development of the Academic Staff, the Regulations for its implementation, and the Procedural Rules of the Technical University – Varna.

I propose to the Scientific Jury to award the educational and scientific degree „Doctor“ to M.Eng. Nevena Milcheva Mileva in the field of higher education 5. Technical Sciences, professional field 5.4. Energy, Doctoral Program in Thermal Engineering.

24.02.2025

Sofia

Member of the scientific jury:

/Prof. Ph.D. Eng. Nina Penkova/