



REVIEW

by Assoc. Prof. PhD. Eng. Sergey Georgiev Belchev
Technical University of Varna

on the dissertation for obtaining the educational and scientific degree "Doctor" of Master Eng.
Daniel Krasimirov Kostadinov

Topic of the dissertation: "Study of the working process of a diesel engine working with the addition of alcohol"

1. Actuality of the problem in the dissertation

In recent years, diesel engines have been developed in the direction of reducing the harmful emissions emitted by them. One of the directions for reaching the required levels of environmental standards is to change the composition of the traditional fuel by adding an alcoholic ingredient. Alcohol additives, such as higher alcohols (butanol) and lower alcohols (ethanol, methanol, isopropanol), are considered a promising alternative, especially for diesel engines, as they can improve fuel efficiency and reduce emissions of harmful substances. However, their impact on the operating process of diesel engines is not yet fully understood, which requires extensive research.

Advantages of alcohols to improve the quality of diesel fuel are:

- Higher energy value: n-butanol has a higher caloric value compared to other alcohols such as ethanol and methanol, which is key to maintaining engine power when running additives without significant energy efficiency losses.
- Better compatibility with diesel fuel: n-butanol has a better solubility in diesel fuel, making it more suitable for use in mixtures with minimal technological changes and without the need to add emulsifiers.
- Higher cetane number: n-butanol has a higher cetane number compared to methanol and ethanol, resulting in a shorter ignition delay time and improving the combustion process.
- Emission reduction: Research has shown that n-butanol has significant potential to reduce harmful emissions such as HC, NO_x and smokiness compared to other alcohols.

Despite significant advances in research on alcohol additives in diesel engines, data on the indication of diesel engines with electronic fuel control when running with added alcohol are still limited. A study including an indication of the work process will be essential for a comprehensive and thorough analysis of the engine's workflow and determining the impact of alcohol additives.

The dissertation is 171 pages long and contains 69 figures, 10 tables, and 116 mathematical dependencies. The material covers an introduction, four chapters, literature used, contributions and a list of publications on the dissertation.

2. Brief biographical data about the PhD student

The PhD student Eng. Daniel Krasimirov Kostadinov graduated from the Technical University of Varna in 2015. He was enrolled in full-time doctoral studies by order of the Rector No. 249 / 20.04.2016. in the doctoral program "Internal Combustion Engines". He was



expelled with the right of defense by order of the Rector No. 337 / 14.07.2020. I have good personal impressions of the doctoral student, of his studies as a bachelor and master in the department.

3. Knowing the status of the problem

The PhD student has carried out an in-depth analysis of 78 literary sources, of which 22 in Cyrillic and 56 in Latin.

The analysis of the problem made by the PhD student and presented in 39 printed pages, showing the possibility of a deep and thorough approach used to solve the main tasks to achieve the goal. With the analysis carried out, the PhD student shows that he knows the scientific achievements in the field of studying the working process of a diesel engine with the addition of alcohol.

The conclusions made at the end of the first chapter reflect the state of the problem and help to correctly formulate the purpose and objectives of the study.

4. Theoretical model of the study

The theoretical calculations are made using a specialized software product AVL BOOST. The calculations are carried out in terms of the properties of the fuel used in the product, as well as the movement of the fuel-air mixture. The program calculates the properties of the mixture at any point in time and determines its current composition.

The description and results presented in the dissertation show a good knowledge of the product on the part of the PhD student and give reason to assume that the results shown are correct and reliable.

5. Assessment of the credibility of the material on which the dissertation contributions are based

The credibility of the material on which the PhD student draws his conclusions and claims contributions is based on the comprehensive and in-depth scientific approach to conducting the research. The detailed description of the equipment used in the measurements, the errors in the measurements and the detailed description of the methodology for conducting the studies indicates that the PhD student knows the devices with which he works and also participates in the conduct of the experimental research. The experimental studies were conducted jointly with a team from the University of Ruse, which further confirms the reliability of the results obtained. The data obtained are determined correctly and correctly, which determines that the analysis of the results is correct and accurate.

6. Contributions of the dissertation

The dissertation is a study of the workflow of a diesel engine with electronic fuel control when butanol is added to pure diesel fuel and determining the influence of different concentrations of the alcohol additive on the engine workflow. The conclusions made after conducting the experimental studies and processing the results obtained are adequate and clearly show the dependencies obtained from the measurements. The scientific, scientific, applied and applied contributions indicated in the dissertation, resulting from the conclusions made and experimental research, are adequate and I accept them as correct and credible.



The obtained and formulated scientific, applied and applied contributions are significant, as they are the result of experimental studies and show the influence of different concentrations of alcohol additive to pure diesel fuel and what is its impact on the combustion process of the engine.

7. Assessment of the degree of participation of the PhD student in the development of the dissertation and contributions

I believe that the doctoral dissertation and the contributions are largely the personal work of the PhD student Eng. Daniel Krasimirov Kostadinov, which is confirmed by the publications included in the dissertation. Knowledge of the subject matter and the participation of the dissertation in conducting experimental research is evident from the topics of the presented scientific papers and the presented figures and graphics in the dissertation. No information has been provided regarding the detection of plagiarism in the dissertation, as well as checks carried out in this direction.

I definitely think that the PhD student independently with the help of his supervisors has developed his dissertation and the contributions indicated in the dissertation are the personal work of Eng. Daniel Kostadinov and his leaders.

8. Evaluation of the publications on the dissertation

Of the four publications mentioned, one is independent, and the others are co-authored with the supervisors, and two are co-authored with another PhD student. All scientific papers have been presented and published in non-refereed editions of Bulgarian scientific forums. No data on open citations of scientific papers are indicated. The scientific information resulting from the dissertation has great potential and it is not a problem for some of the research to be reported in international scientific forums indexed in world-famous databases.

9. Use of research results in scientific and social practice

The results of the dissertation work have great scientific and applied potential. There are no documents attached to the dissertation for implementation in practice or for high scientific achievements. However, the results obtained have the capacity to achieve great socio-economic benefits from the use of fuels with alcohol additives.

10. Implementation of the research results

The results of the dissertation are useful and are subject to direct use and implementation in practice in the use of additives to diesel fuel to improve the work process, reduce the emissions emitted by cars, which will lead to an increase in the opportunities for improving road safety and urban mobility in large settlements. Their implementation in the educational process is also quite adequate.

11. Evaluation of the abstract

The abstract presented with the dissertation meets the requirements for the preparation of an abstract and the Abstract Act, reflecting the main provisions in the dissertation. The abstract is 42 pages long, presenting everything necessary to assess the content and essence of the dissertation.



12. Critical Notes

I have no comments on the dissertation, it is a useful experimental study with a specific contribution in the field of diesel internal combustion engines when working with the addition of alcohol in traditional fuel and meets the requirements for the submission of a doctoral dissertation and an abstract under the Law on the Prevention of Alcohol.

13. Other questions about the review

I have no additional questions that are directly related to the preliminary opinion to the presented dissertation and abstract.

14. Conclusion with a clear opinion

On the basis of the materials on the dissertation and the results obtained by the PhD student Mag. Eng. Radostin Dimitrov Dimitrov, I believe that all the requirements for awarding the scientific and educational degree "Doctor" have been met and I recommend to the esteemed jury to award the doctoral and scientific degree "Doctor" in the professional field 5.1. Mechanical Engineering, PhD Program "Internal Combustion Engines".

06.06.2025
Varna

Reviewer:.....
/Assoc. Prof. Dr. Eng. S. Belchev/