I. IDENTIFICATION DATA

Thesis name:	**Experimental study into sub-lethal exposure of bacteria to nanoparticles and the possible development of resistance**
Author's name:	**Mohammed Fadel**
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Physics
Thesis reviewer:	RNDr. Pavel Galář, Ph.D.
Reviewer's department:	University of Chemistry and Technology, Prague

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**challenging**

Evaluation of thesis difficulty of assignment.

The aim of the presented work was to evaluate the toxicity of nano and micro particles of ZnO for *E. coli* bacteria. The student should also verify the possible rise of resistance of these bacteria to ZnO. While the goals and course of the implementation of the work was clearly specified, the student had to create a methodology for the implementation.

Satisfaction of assignment	**fulfilled with major objections**

Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.

Based on the assignment, the student performed toxicity test of ZnO particles on used bacteria. In particular, the effect of three different concentrations of ZnO particles were studied. However, in the second step of the research, student realized only one additional repetition of the ZnO treatment that is insufficient for obtaining reliable results related to the development of bacterial resistivity. The results of the experiments are also insufficiently discussed and concluded.

Method of conception	**correct**

Assess that student has chosen correct approach or solution methods.

Appropriate sample preparation methods as well as evaluation methods were developed.

Technical level	**C - good.**

Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.

The student demonstrated a good knowledge of the applied experimental equipment and of the impacted literature related to the project.

Formal and language level, scope of thesis	**E - sufficient.**

Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.

The realization of the thesis is the weakest point of the whole work. The language level is below average, the work contains rather high concentration of typographic and formal errors. In particular, the work does not contain standard review/state-of-art part, where the author would summarize current level of knowledge in the topic and describe, for example, the phases of bacterial grown curve or published values of lethal doses of nanoparticles for *E. coli* bacteria. Instead, he presents this information piecewise at various places of theses. The figures do not contain a standard caption, but only a short sentence above the body of the figure is presented, which is more reminiscent of the title. The format of the concentration notation and samples labelling differ within the thesis and the author often mixing results obtained using micro and nano ZnO, etc. Missing accurate information about presented figures together with many typos and mentioned language level make some parts of the thesis difficult to understand.

Selection of sources, citation correctness	**B - very good.**

Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.

Leaving aside the absence of a compact review part, the student presents relevant citations. Their scope and quantity exceeds the average of the bachelor's thesis.

Additional commentary and evaluation

Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.

See final evaluation

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation. Please present apt questions which student should answer during defense.

The submitted bachelor thesis was very well assigned. The goals have a clear logic and meaning, it was appropriately designed (material, bacteria, analytical methods, etc.) how to achieve these goals and if properly implemented, the work could bring interesting application results. However, the work did not meet these expectations. In particular, a sufficient number of intoxication repetitions necessary for determination of bacterial resistivity development were not performed and the obtained results are not properly presented and discussed. However, the student proved good knowledge of relevant publications and needed to handle set of experimental techniques. I also understand that the work was created during the pandemic year. So, despite the above complaints, I evaluate the work as D and I also recommend it for defense, if the following questions are sufficiently answered:

1) Why were the ZnO concentrations of 10, 100 and 1000 µg/ml chosen for the implementation of the study?
2) Explain the logic of the content of chapter 4.2 that roughly presents the main results of the study, while the ongoing data are given in the following subchapters?
3) Why the ZnO microscopic particles are also toxic to *E. coli* bacteria, when their size is several times larger than the bacteria itself and therefore, unlike nano ZnO, they cannot penetrate the given bacteria?
4) Can you give a clear summary of the study? The current form of the conclusion is insufficient.

I evaluate handed thesis with classification grade **D - satisfactory.**

Date: **29.1.2021**   Signature: